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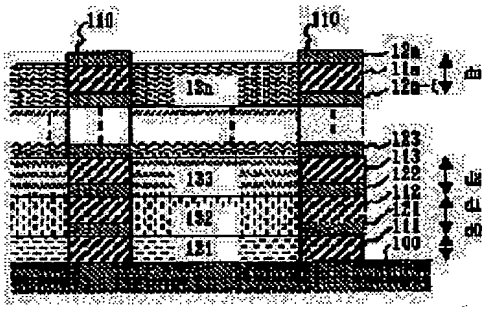
(54) THIN FILM FORMING METHOD, DISPLAY DEVICE, AND COLOR FILTER

(57)Abstract:
PROBLEM TO BE SOLVED: To reduce the cost needed for controlling affinity and to obtain a multi-layered thin film uniform in film thickness.
SOLUTION: A bank 110 having affinitive bank layers and nonaffenitive bank layers stacked by turns is formed by repeating more than once a process for forming the affinitive bank layers 111 to 11n of materials (inorganic material such as SiO2) affinitive with thin film material liquid and a process for forming nonaffinitive bank layers 121 to 12n of materials (organic material such as result) nonaffinitive with the thin film material liquid. Lastly, the thin film material liquid is charged between banks by an ink jet system and thermally treated to stack thin film layers 131 to 13n in order.



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CLAIMS

[Claim(s)]

[Claim 1] The process which is the thin film formation approach which fills up with thin film material liquid the field surrounded on the bank, and forms a thin film layer in it, and forms said bank in a bank forming face, The process which equips said bank with the process filled up with said thin film material liquid, and forms said bank in it By repeating the process which forms a compatibility bank layer with the ingredient in which compatibility is shown to said thin film material liquid, and the process which forms a non-compatibility bank layer with the ingredient which shows non-compatibility to said thin film material liquid on said compatibility bank layer once or more The thin film formation approach characterized by being that in which a compatibility bank layer and a non-compatibility bank layer form said bank by which the laminating was carried out by turns.

[Claim 2] The thin film formation approach according to claim 1 further equipped with the process which performs predetermined surface treatment to said bank and a bank forming face after the process which forms said bank.

[Claim 3] The process which performs said surface preparation is the thin film formation approach according to claim 2 of performing surface preparation under fixed conditions to which said non-compatibility bank layer becomes [extent of the non-compatibility over said thin film material liquid] higher compared with said compatibility bank layer.

[Claim 4] The process which performs said surface preparation is the thin film formation approach according to claim 3 of performing surface preparation under fixed conditions from which the compatibility over said thin film material liquid of said compatibility bank layer turns into below the compatibility over said thin film material liquid of the field surrounded on said bank further.

[Claim 5] Said surface treatment is the thin film formation approach according to claim 2 which is the plasma treatment which carries out a plasma exposure under the ambient atmosphere in which the gas which contained the fluorine or the fluorine compound in introductory gas was used, and oxygen was contained.

[Claim 6] Said fixed conditions are the thin film formation approach according to claim 3 on condition of there being more fluorine system compounds than oxygen.

[Claim 7] Said fixed conditions are the thin film formation approach according to claim 6 that the content of a fluorine system compound and the fluorine system compound to the total amount of oxygen is set up to 60% or more.

[Claim 8] The gas containing said fluorine is the thin film formation approach according to claim 5 of using the halogen gas of CF4, SF6, and CHF3 grade.

[Claim 9] To said thin film material liquid, for a contact angle, said compatibility bank layer front face is said thin film formation approach according to claim 2 by which surface treatment is carried out so that it may become 30 or less degrees.

[Claim 10] To said thin film material liquid, for a contact angle, said non-compatibility bank layer front face is said thin film formation approach according to claim 2 by which surface treatment is carried out so that it may become 40 degrees or more.

[Claim 11] The compatibility bank layer formation process which forms the compatibility film with said compatibility ingredient in the process which forms said bank, The non-compatibility bank layer formation process which forms a non-compatibility bank layer with a non-compatibility ingredient according to the formation field of said bank on said compatibility bank layer, The thin film formation approach according to claim 1 which resembles the removal process which etches and removes said compatibility bank layer of the field in which the non-compatibility bank layer concerned is not prepared by using said non-compatibility bank layer as a mask, and forms the compatibility bank layer of a lot, and a non-compatibility bank layer more.

[Claim 12] The process in which the process which forms said bank forms a compatibility bank layer with said compatibility ingredient, The process which etches the compatibility bank layer concerned according to the formation field of said bank lower layer, The process which covers said compatibility bank layer and forms a non-compatibility bank layer with a non-compatibility ingredient, The thin film formation approach according to claim 1 which resembles the process which etches the non-compatibility bank layer concerned according to the formation field of said bank upper layer, and forms the non-compatibility bank layer of a lot, and a non-compatibility bank layer more.

[Claim 13] The thin film formation approach given in either claim 11 which forms said non-compatibility bank layer with a photosensitive ingredient, or claim 12.

[Claim 14] It is the thin film formation approach according to claim 1 that said compatibility ingredient is an inorganic material and said non-compatibility ingredient is an organic material.

[Claim 15] Said non-compatibility ingredient is the thin film formation approach according to claim 1 which is either the organic compound which has polyimide, an amorphous silicon, polish recon, and a fluorine, or an insulating organic compound.

[Claim 16] Said compatibility ingredient is the thin film formation approach according to claim 1 which is either metals, such as aluminum and Ta, silicon oxide or a silicon nitride.

[Claim 17] Said thin film layer is the thin film formation approach according to claim 1 that the thin film layer of the lowest layer is set as the compatibility bank layer of the lowest layer of said bank, and the thickness of an abbreviation EQC.

[Claim 18] Said thin film layer is the thin film formation approach according to claim 1 set as the sum total of each thickness of the compatibility bank layer by which the laminating of each thin film layer by which a laminating is carried out above the lowest layer is carried out to the height to which said bank corresponds, and a non-compatibility bank layer, and the thickness of an abbreviation EQC.

[Claim 19] It is the thin film formation approach according to claim 1 that the thickness of said non-compatibility bank layer in the maximum upper layer is set as 500nm or less, and the thickness of said other non-compatibility bank layer is set as 100nm or less.

[Claim 20] The process which forms the process which forms said non-compatibility bank layer, and said compatibility bank layer is the thin film formation approach according to claim 1 which applies the predetermined ingredient melted by the solvent, forms each bank layer, and forms said non-compatibility bank layer by applying the ingredient of said non-compatibility bank layer before the solvent which had melted the ingredient of said compatibility bank layer is removed.

[Claim 21] It is the indicating equipment constituted by carrying out the laminating of the thin film layer which filled up with thin film material liquid the field surrounded on the bank, and was formed in it. Said bank The laminating of the compatibility bank layer which shows compatibility to said thin film material liquid, and the non-compatibility bank layer which shows non-compatibility to said thin film material liquid is carried out by turns. The display characterized by forming said thin film layer with the organic-semiconductor ingredient for the pixel electrode which consists of ITO etc. being prepared in the field surrounded on said bank, and forming a thin film light emitting device.

[Claim 22] Said compatibility bank layer or/and said non-compatibility bank layer are a display according to claim 21 by which surface treatment is carried out so that compatibility or non-compatibility may be shown, respectively.

[Claim 23] It is the color filter constituted by carrying out the laminating of the thin film layer which filled up with thin film material liquid the field surrounded on the bank, and was formed in it. Said bank The laminating of the compatibility bank layer which shows compatibility to said thin film material liquid, and the non-compatibility bank layer which shows non-compatibility to said thin film material liquid is carried out by turns. It is the color filter characterized by forming a bank forming face with a transparence substrate, and forming said thin film layer with the coloring resin ingredient for said bank being a batch member into which a pixel field is divided, and giving color to said pixel.

[Claim 24] Said compatibility bank layer or/and said non-compatibility bank layer are a color filter according to claim 23 by which surface treatment is carried out so that compatibility or non-compatibility may be shown, respectively.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the thin film coating technology suitable for manufacture of the display and a light filter equipped with EL (electroluminescence) component or the LED (light emitting diode) component. In case a multilayer thin film layer is formed especially between batch members, it is related with an advantageous technique.

[0002]

[Description of the Prior Art] The technique of it being filled up with ingredients, such as organic-semiconductor film in a display and coloring resin in a light filter, using an ink jet method, and manufacturing the liquid crystal panel for color displays has been used. The batch member into which a pixel field is divided in order for the breathed-out thin film material liquid to prevent flowing into the next pixel, when filling up an ingredient with an ink jet method (henceforth "a bank") Moreover, the layer which constitutes a batch member is called "bank layer". It is necessary to prepare and to fill up with thin film material liquid the field surrounded by the batch member. The pixel field surrounded by the batch member is filled up with far large thin film material liquid compared with the volume after membrane formation. However, since a thing thin generally is required, a display cannot form a batch member highly indiscriminately. The behavior of the thin film material liquid filled up with what kind of wettability (compatibility) the field surrounded by the batch member or the batch member shows from this to thin film material liquid differs.

[0003] When a batch member is filled up with the ingredient of the amount which exceeds the height of a batch member as shown in drawing 9 (a) as it is compatibility to an ingredient, even if there is a batch member, an ingredient will flow into the pixel field which adjoins easily. Conversely, even if a batch member is filled up with the ingredient of the amount which exceeds the height of a batch member as shown in drawing 9 (b) as it is non-compatibility to an ingredient, an ingredient does not flow into the next pixel field with the surface tension of an ingredient. However, since an ingredient will be crawled by the side attachment wall of a batch member if this ingredient is heated and a solvent is evaporated, as shown in drawing 9 (c), the thickness after membrane formation becomes it is thick and thin in the center section of the pixel field at a periphery. Now, an irregular color arises or dependability falls. Moreover, if a batch member is constituted from a non-compatibility member, the adhesion force with the ground plane of a batch member and a batch member will be weak, and a batch member will become easy to separate.

[0004] There was a technique which carries out surface treatment so that the upper part of a batch

member may be made into non-compatibility and the other part may become compatibility as a Prior art which solves such a problem. For example, the technique of processing the upper part of a batch member into ** ink nature by UV irradiation, and processing into parent ink nature the field surrounded by the batch member is indicated by JP,9-203803,A and JP,9-230129,A. The former applies to the upper part of a batch member the layer which shows ** ink nature (non-compatibility), and the latter makes the crevice further surrounded by UV irradiation by the batch member parent ink nature (compatibility). The logical consideration is indicated by International Display Research Conference 1997 and pp 238-241. According to this technique, even if it fills up the height exceeding a batch member with an ingredient, as shown in drawing 10 (a), an ingredient is crawled with the film of non-compatibility and does not flow into the next pixel field. Moreover, since the side attachment wall of a batch member is equipped with compatibility, the thickness after membrane formation does not become thin around a pixel field.

[0005]

[Problem(s) to be Solved by the Invention] However, it was difficult to obtain a thin film layer that it is not clear how the compatibility in the side attachment wall of a batch member is set up also in the above-mentioned well-known technique, and flat. Although the purport which controls extent of compatibility by irradiating ultraviolet rays from both sides of a front flesh side was specified especially to JP,9-230129,A, about how the contact angle over extent, i.e., the thin film material liquid, of the compatibility of non-compatibility and compatibility is set up, respectively, it was unknown. For example, if non-compatibility is too high, as shown in drawing 9 (c), a thin film layer will become it is thin and thick in the center section by the periphery near a batch member. On the contrary, if compatibility is too high, as shown in drawing 10 (b), a thin film layer will become it is thick and thin in the center section by the periphery near a batch member.

[0006] Moreover, since the thin film layer came out further with the above-mentioned well-known technique and a certain thing was only assumed, it was completely unknown about the surface treatment which can form a flat thin film layer for every field coalescence layer which multilayers a thin film layer. temporary -- much more -- ** -- if it becomes, whenever [for which is boiled and the above-mentioned well-known technique is applied] it forms further, surface treatment will be required, and many processes will be required dramatically.

[0007] The invention-in-this-application person discovered that the contact angle over ink changed greatly between the organic substance and an inorganic substance with mixing ratios of oxygen gas and fluorine gas, when plasma treatment was carried out by the gas of a fluorine system. And the invention-in-this-application person hit on an idea to control [preparing the bank which carried out the laminating of a compatibility ingredient and the non-compatibility ingredient by turns, and] compatibility by plasma treatment.

[0008] That is, the 1st technical problem of this invention is offering the thin film formation approach which can multilayer a thin film by carrying out the laminating of the bank with a different ingredient.

[0009] Moreover, the 2nd technical problem of this invention is controlling compatibility, without passing through many processes for compatibility control, reducing the cost which compatibility control takes to this, and enabling multilayering of a thin film by uniform thickness by managing surface treatment under fixed conditions.

[0010] The 3rd technical problem of this invention is offering the display multilayered by the thin film formation approach which makes multilayering possible. It is this performing image display which

unevenness's produces neither in brightness nor a color, and raising dependability.

[0011] The 4th technical problem of this invention is offering the light filter multilayered by the thin film formation approach which makes multilayering possible. It is that this performs image display which unevenness produces neither in brightness nor a color.

[0012]

[Means for Solving the Problem] Invention which solves the 1st technical problem of the above is the thin film formation approach which fills up with thin film material liquid the field surrounded on the bank, and forms a thin film layer in it, and is equipped with the process which forms a bank in a bank forming face, and the process which fills up a bank with thin film material liquid. And the process which forms a bank forms the bank by which the laminating was carried out by turns in the compatibility bank layer and the non-compatibility bank layer by repeating the process which forms a compatibility bank layer with a compatibility ingredient, and the process which forms a non-compatibility bank layer with a non-compatibility ingredient on a compatibility bank layer once or more.

[0013] The thing of the batch member which prepares a bank in order to divide the pixel of the display using for example, a non-compatibility semi-conductor thin film, or is prepared in order to divide the pixel field of a light filter is said here. The laminated structure of a bank may change and use the class of a non-compatibility ingredient or compatibility ingredient for every layer. The laminating of the thickness of each class may be changed and carried out for every layer. A bank forming face may be a field which prepares this bank, and may be actuation substrates, such as a display, or may be transparence substrates, such as a light filter, etc.

[0014] It is decided whether to be compatibility here or be non-compatibility by with what kind of property the thin film material liquid with which it is filled up is equipped. For example, if it is thin film material liquid with a hydrophilic property, the front face which has a polar group shows compatibility, and the front face which has a nonpolar group shows non-compatibility. Conversely, if it is thin film material liquid with oleophilic, the front face which has a polar group shows non-compatibility, and the front face which has a nonpolar group shows compatibility. for manufacture, it will boil variously as what thin film material liquid is used, it will change, and will apply. thin film material liquid -- much more -- ** -- when whether it is alike and a hydrophilic property is shown or hydrophobicity is shown change, as a lower layer shows non-compatibility to this thin film material liquid among the bank layers of the bilayer prepared in the location corresponding to the thin film layer formed with that thin film material liquid and the upper layer shows compatibility, a layer system can be changed and it can apply. For example, when thin film material liquid has a hydrophilic property, an inorganic material is called compatibility ingredient and an organic material is called good non-compatibility ingredient. When thin film material liquid has hydrophobicity, an organic material is called compatibility ingredient and an inorganic material is called good non-compatibility ingredient.

[0015] For example, how to form the above-mentioned bank layer by spreading of an ingredient can be considered. That is, the process which forms the process which forms a non-compatibility bank layer, and said compatibility bank layer applies the predetermined ingredient melted by the solvent, and forms each bank layer. And before the solvent which had melted the ingredient of a compatibility bank layer is removed, a non-compatibility bank layer is formed by applying the ingredient of a non-compatibility bank layer.

[0016] Invention which solves the 2nd technical problem of the above is further equipped with the process

which performs predetermined surface treatment to a bank and a bank forming face after the process which forms the above-mentioned bank. As surface treatment, the gas which contained the fluorine or the fluorine compound in introductory gas, for example is used, and the reduced pressure plasma treatment and atmospheric pressure plasma treatment which carry out a plasma exposure under a reduced pressure ambient atmosphere and an atmospheric pressure ambient atmosphere are performed. Performing plasma treatment in the gas containing a fluorine system compound and oxygen as fixed conditions is mentioned. Under these conditions, on the surface of an inorganic material, an unreacted radical occurs by plasma discharge, an unreacted radical oxidizes by oxygen and polar groups, such as a carbonyl group and a hydroxyl group, occur. A polar group shows compatibility to the fluid containing polar molecules, such as water, and shows non-compatibility to the fluid containing a nonpolar molecule. The phenomenon in which a fluorine system compound molecule enters an organic material front face in parallel to the above reactions also in an organic bank layer front face is also produced.

[0017] When the content of a fluorine system compound and the fluorine system compound to the total amount of oxygen is set up to 60% or more when there are more especially fluorine system compounds than oxygen for example, since the mixing-ized phenomenon of a fluorine system compound prospers rather than the oxidation reaction by oxygen, by gas ambient atmosphere-ization with the excessive amount of a fluorine system compound, a front face is un-polarized by the mixing-ized phenomenon rather than the effect by oxidation reaction. Therefore, when a fluorine system compound carries out plasma treatment of the organic material on excessive conditions, non-compatibility is shown to the fluid containing a polar molecule, and compatibility comes to be shown to the fluid containing a nonpolar molecule. For example, the gas containing a fluorine uses the halogen gas of CF4, SF6, and CHF3 grade. If surface preparation is performed under these conditions, the compatibility of that front face will be adjusted so that the contact angles over thin film material liquid may differ greatly between a non-compatibility bank layer and a compatibility bank layer. Thereby, to thin film material liquid, surface treatment for example, of the compatibility bank layer front face is carried out so that a contact angle may become 30 or less degrees. Moreover, to thin film material liquid, surface treatment of the non-compatibility bank layer front face is carried out so that a contact angle may become 40 degrees or more.

[0018] The process which performs the above-mentioned surface preparation performs surface preparation under fixed conditions to which a non-compatibility bank layer becomes [extent of the non-compatibility over thin film material liquid] higher compared with a compatibility ingredient. The process which furthermore performs surface preparation performs surface preparation under fixed conditions from which the compatibility over the thin film material liquid of a compatibility bank layer turns into below the compatibility over the thin film material liquid of the field surrounded on a bank.

[0019] The compatibility bank layer formation process which forms the compatibility film with a compatibility ingredient in the process which forms the above-mentioned bank, for example, The non-compatibility bank layer formation process which forms a non-compatibility bank layer with a non-compatibility ingredient according to the formation field of a bank on a compatibility bank layer, The clearance process which etches and removes the compatibility bank layer of the field in which the non-compatibility bank layer concerned is not prepared is resembled by using a non-compatibility bank layer as a mask, and the compatibility bank layer of a lot and a non-compatibility bank layer are formed more. Moreover, the process which forms a bank looks like [the process which forms a compatibility bank

layer with a compatibility ingredient, the process which etch the compatibility bank layer concerned according to the formation field of a bank lower layer, the process which cover a compatibility bank layer and form a non-compatibility bank layer with a non-compatibility ingredient, and the process which etch the non-compatibility bank layer concerned according to the formation field of the bank upper layer], and forms the non-compatibility bank layer of a lot, and a non-compatibility bank layer more. In addition, after piling up all or almost all the compatibility bank layer, and a non-compatibility bank layer, without carrying out etching to a bank configuration each time, two or more sets of compatibility bank layers and a non-compatibility bank layer may be etched at a stretch collectively.

[0020] Here, for example, a non-compatibility ingredient is either the organic compound which has polyimide, an amorphous silicon, polish recon, and a fluorine, or an insulating organic compound (photosensitive ingredient). A compatibility ingredient is either metals, such as aluminum and Ta, silicon oxide or a silicon nitride.

[0021] Preferably, the thin film layer is set as the compatibility bank layer of the lowest layer of a bank of the thin film layer of the lowest layer, and the thickness of an abbreviation EQC. Moreover, each thin film layer by which a laminating is carried out above the lowest layer is set as the sum total of each thickness of the compatibility bank layer by which the laminating is carried out to the height to which a bank corresponds, and a non-compatibility bank layer, and the thickness of an abbreviation EQC. The thin film material liquid with which it filled up changes the contact configuration of the wall surface and oil level with the compatibility of the wall surface of a bank. It is in the inclination for the thickness of a thin film to decrease in it since thin film material liquid is crawled by the inclination which thin film material liquid sticks with a wall surface, and the thickness of a thin film increases in the contact surface with a non-compatibility bank layer, in the contact surface with a compatibility bank layer. Although the volume decreases by heat-treatment etc., if the thin film material liquid with which it filled up so much is adjusted so that the oil level of the thin film material liquid after heat-treatment termination may be located in the boundary of a non-compatibility bank layer and a compatibility bank layer, the property of a non-compatibility bank layer and a compatibility bank layer is balanced, the oil level of thin film material liquid will become vertical to a bank wall surface, and, on the whole, it will become flat. For example, the thickness of 500nm or less and the other non-compatibility bank layer is set as 100nm or less for the thickness of the non-compatibility bank layer in the maximum upper layer.

[0022] Invention which solves the 3rd technical problem of the above is an indicating equipment constituted by carrying out the laminating of the thin film layer which filled up with thin film material liquid the field surrounded on the bank, and was formed in it. Said bank The compatibility bank layer formed with the ingredient in which compatibility is shown to said thin film material liquid, The laminating of the non-compatibility bank layer formed with the ingredient in which non-compatibility is shown to said thin film material liquid is carried out by turns. It is the display characterized by forming said thin film layer with the organic-semiconductor ingredient for the pixel electrode which consists of ITO etc. being prepared in the field surrounded on said bank, and forming a thin film light emitting device.

[0023] Invention which solves the 4th technical problem of the above is a light filter constituted by carrying out the laminating of the thin film layer which filled up with thin film material liquid the field surrounded on the bank, and was formed in it. Said bank The compatibility bank layer formed with the ingredient in which compatibility is shown to said thin film material liquid, The laminating of the

non-compatibility bank layer formed with the ingredient in which non-compatibility is shown to said thin film material liquid is carried out by turns. It is the light filter characterized by forming a bank forming face with a transparence substrate, and forming said thin film layer with the coloring resin ingredient for said bank being a batch member into which a pixel field is divided, and giving color to said pixel.

[0024] In addition, in the above-mentioned indicating equipment or a light filter, surface treatment of a compatibility bank layer or/and the non-compatibility bank layer is carried out so that compatibility or non-compatibility may be shown, respectively.

[0025]

[Embodiment of the Invention] Next, the gestalt of suitable operation of this invention is explained with reference to a drawing.

(Operation gestalt 1) The operation gestalt 1 of this invention is related with the thin film formation approach of using one layer as a mask of the layer of another side among two or more kinds of layers which constitute a bank. The sectional view of the thin film laminated structure formed in drawing 1 by the thin film formation approach of this invention is shown. This laminated structure is usable for all the applications that use the multilayered thin film. For example, it is usable to the EL element using an organic-semiconductor thin film, LED, a light filter, etc. The laminated structure of drawing 1 is the structure in the case of using what has a hydrophilic property as thin film material liquid. With thin film material liquid with a hydrophilic property, compatibility becomes [compatibility] high low at an organic material at the inorganic material by which surface treatment was carried out (non-compatibility).

[0026] As shown in drawing 1 , this laminated structure establishes bank 110 in the bank forming face 100, and is constituted. Even if a bank forming face is a transparence substrate used for a light filter even if it is the actuation substrate with which the thin film transistor (TFT:Thin Film Transistor) used for an indicating equipment was formed, it is good anything. If it is the object which fills up with a fluid the field surrounded on a batch member slack bank, and forms a thin film in it, there will be no definition in the structure of a bank forming face. However, it is desirable that it is the good ingredient of the compatibility bank layer 111 and adhesion which forms the lowest layer of bank 110. It is desirable in order that consisting of especially inorganic materials may acquire suitable compatibility by next surface treatment. If ITO, silicon, etc. which are a transparent electrode if it is a display are a light filter, it consists of glass, a quartz, etc. and high adhesion with a compatibility bank layer can be maintained.

[0027] Bank 110 carries out the laminating of the compatibility bank layers 111-11n (n is the natural number) and the non-compatibility bank layers 121-12n by turns, and is constituted. Surface treatment of the compatibility bank layers 111-11n is carried out so that it may have the thin film material liquid which forms the thin film layers 131-13n of the location corresponding to the layer, and fixed compatibility. It may be desirable that it is the good ingredient of the bank forming face 100, the non-compatibility bank layers 121-12n, and adhesion as a compatibility bank layers [111-11n] ingredient, and the ingredient may have insulation, a property as a semi-conductor, and conductive any. For example, it is possible to use metals, such as general aluminum, Ta, etc. as an insulator layer as compatibility bank layers 111-11n, silicon oxide (SiO2), a silicon nitride (SiNx), etc. It is not necessary to use the same ingredient for each compatibility bank layer. each -- it is not necessary to unify all the compatibility bank layers into the same ** y wax that the thin film material liquid and compatibility of thin film layer 13x which are established corresponding to compatibility bank layer 11x (x is the natural number of arbitration) should just be a good ingredient

[0028] Surface treatment of the non-compatibility bank layers 121-12n is carried out so that the thin film material liquid and the non-compatibility which form the thin film layers 131-13n of the location corresponding to the layer may be **(ed). It may be desirable that it is the good ingredient of the compatibility bank layers 111-11n and adhesion as a non-compatibility bank layers [121-12n] ingredient, and the ingredient may have insulation, a property as a semi-conductor, and conductive any. For example, it is possible to use an organic compound or an insulating organic compound etc. which has polyimide, an amorphous silicon, polish recon, and a fluorine as non-compatibility bank layers 121-12n. It is not necessary to use the same ingredient for each ******** bank layer. the case where surface preparation is carried out -- each -- if it is the ingredient with which the thin film material liquid and compatibility of thin film layer 13x prepared corresponding to compatibility bank layer 11x (x is the natural number of arbitration) become good, an ingredient is changed and a laminating is possible. For example, when applying this laminated structure to a light filter, the 12n of the maximum upper layers may be constituted from a black matrix, and an electric shielding function may be made to make it serve a double purpose. In order to form as a covered member, metals and oxide, such as chromium, and a black resist ingredient are used.

[0029] The thickness of each bank layer is set up as follows. When the lowest layer is the compatibility bank layer 131, it sets up so that the thickness d0 of the compatibility bank layer 131 may turn into thickness of the thin film layer 131 formed corresponding to this layer to an abbreviation EQC. the layer of a moreover -- the non-compatibility bank layer 11 -- it sets up so that it may become an abbreviation EQC in the thickness of x+1 and thin film layer 13x+1 in which the thickness dx adding compatibility bank layer 12x is formed corresponding to these layers. for example, the thickness d1 in which the thickness of the thin film layer 132 totaled the non-compatibility bank layer 121 and the compatibility bank layer 112 -- abbreviation -- it is equal. the thickness dn in which the thickness of 13n of thin film layers totaled 12n [of non-compatibility bank layers] - 1 and 11n of compatibility bank layers -- abbreviation -- it is equal. These setting out is important in order to form a flat thin film layer.

[0030] In addition, the above-mentioned laminated structure is applied when thin film material liquid consists of molecules with a polar group. When thin film material liquid consists of molecules without a polar group, it is used replacing the ingredient of a non-compatibility bank layer and a compatibility bank layer. moreover, a thin film layer -- much more -- ** -- what is necessary is just to choose the ingredient of a bank layer, as a lower layer shows non-compatibility to this thin film material liquid among the bank layers of the bilayer in the location where it fills up with each thin film material liquid and the upper layer shows compatibility when it consists of molecules which are alike and have a polar group or consists of molecules without a polar group

[0031] The thin film layers 131-13n consist of ingredients with which each was equipped with the target property. For example, when applying this laminated structure to a display, the organic-semiconductor thin film material liquid of arbitration is filled up with and formed in each thin film layer. Two or more laminatings of the organic-semiconductor thin film material liquid which emits light in primary color are carried out for every thin film layer, or the laminating of the ingredient of an electron hole transporting bed or an electronic transporting bed is filled up with and carried out if needed. For example, when applying this laminated structure to a light filter, the laminating of the resin with which refractive indexes differ is filled up with and carried out to each thin film layer. Such a laminating diaphragm structure serves as an optical interference filter, and only the light of specific wavelength is penetrated

and it becomes the configuration which can offer the good color of selectivity. A black matrix may be applied to the maximum upper layer of a bank. **** yoke chromic oxide, a **** black resist, etc. are applied. This layer may be a non-compatibility layer and combination, or a non-compatibility layer may be prepared separately. As mentioned above, each thin film layers [131-13n] thickness spreads abbreviation etc., and is set as the thickness which totaled the non-compatibility bank layer currently formed in the location corresponding to the thin film layer, and the compatibility bank layer.

[0032] (Operation of a laminated structure) According to the layer system of the above-mentioned bank, the equipment with which the thickness of each class carried out the laminating of the uniform thin film layer can be offered. If the bank 110 is manufactured in the above-mentioned configuration, flattening of the thickness of a thin film layer will be carried out. That is, restoration of thin film material liquid changes the contact configuration of the oil level of thin film material liquid to the wall surface with the compatibility of the wall surface of a bank. In the contact surface with a compatibility bank layer, it becomes the inclination for the thickness of a thin film to decrease in it since thin film material liquid is crawled by the inclination which thin film material liquid sticks with a wall surface, and the thickness of a thin film increases in the contact surface with a non-compatibility bank layer. Although the volume decreases by heat-treatment etc., if the thin film material liquid with which it filled up so much is adjusted so that the oil level of the thin film material liquid after heat-treatment termination may be located in the boundary of a non-compatibility bank layer and a compatibility bank layer, the property of a non-compatibility bank layer and a compatibility bank layer is balanced, the oil level of thin film material liquid will become vertical to a bank wall surface, and, on the whole, it will become flat.

[0033] With the equipment which used this laminated structure, fixed effectiveness is done so from a thin film layer being flat. In passing a current to inter-electrode as the thickness of each thin film layer is uniform, and forming in a luminescence mold display device, inter-electrode current density becomes fixed, the homogeneity of luminescence can be improved, and since the current concentration to a specific part is avoidable, dependability improves. Moreover, since electric field are not built over a thin part with the component with which an electrical potential difference is impressed to inter-electrode, dependability can improve and a life can be prolonged. Furthermore, a color and brightness are equalized. Moreover, when applying to a light filter, the homogeneity of a color can be raised and failures, such as a color omission, can be prevented.

[0034] (The manufacture approach) The thin film formation approach for next obtaining this laminated structure is explained with reference to drawing 2 and the production process sectional view of drawing 3 . Bank formation process (drawing 2 (a) - (d)) : A bank formation process is a process which carries out the laminating of the compatibility bank layers 111-11n and the non-compatibility bank layers 121-12n to the bank forming face 100, and forms bank 110. The compatibility bank layer 111 is first formed in the bank forming face 100 whole surface (drawing 2 (a)). although the formation approach changes with ingredients -- PECVD (Plasma Enhanced ChemicalVapor Deposition) -- law and CVD (Chemical Vapor Deposition) -- there are law, vacuum deposition, and a spatter and various kinds of coat approaches (a spin coat, a spray code, a roll coat, a die coat, DIP coat). For example, with this operation gestalt, SiO2 film by SOG (Spin onGlass) is formed with a spin coat method. The thickness of the compatibility bank layer 111 of the lowest layer is doubled with the thickness of the thin film layer 131. Subsequently, the non-compatibility bank layer 121 is formed according to a bank configuration (drawing 2 (b)). The formation approach of a non-compatibility bank layer forms an organic material in the whole surface by

the above-mentioned approach first. In using the usual photolithography method, a mask is given according to a bank configuration, and it exposes, develops and removes a resist, and it etches at the end and the organic material of parts other than a mask is removed. When using print processes, an organic material is directly applied to a bank configuration by the approach of arbitration, such as an intaglio, lithography, and letterpress. The thickness of the non-compatibility bank layer 121 makes the function which crawls the thin film material liquid with which it fills up behind the thickness of extent which does so enough. However, it adjusts in the range in which the thickness doubled with the following compatibility bank layer 112 put on this layer becomes an abbreviation EQC in the thin film layer 132. Subsequently, the inorganic material film is etched by using the non-compatibility bank layer 121 as a resist mask (drawing 2 (c)). A non-compatibility bank layer is an organic material, and it is because it can act as a resist mask. Subsequently, SOG is again applied to the whole surface as an inorganic material like drawing 2 (a) (drawing 2 (d)). The thickness of an inorganic material makes the thin film material liquid with which it fills up behind, and the function to stick the thickness of extent which does so enough. However, it adjusts in the range in which the thickness doubled with the non-compatibility bank layer 121 put on the bottom of this layer becomes an abbreviation EQC in the thin film layer 132. The bank is repeated, repeating the process of drawing 2 (b) - (d) henceforth. The laminating of the maximum upper layer is carried out so that 12n of non-compatibility bank layers may be arranged. Supposing the maximum upper layer does not have non-compatibility, it is because the thin film material liquid with which it filled up overcomes bank 110 and flows out.

[0035] The structure which consists of a crevice 101 surrounded on the bank 110 as shown in drawing 2 (e) according to the above-mentioned process, and the bank is formed. The bank of multilayer structure where the laminating of the layer which shows the layer which shows compatibility, and non-compatibility according to this structure was carried out by turns is formed. What is necessary is just to shift to the process which carries out sequential restoration of the thin film material liquid in a crevice 101 next, as shown in drawing 3 (b). However, surface treatment which adjusts extent of the compatibility over the thin film material liquid of the bank forming face 100 and each class of bank 110 as shown below here will be performed.

[0036] Surface-preparation process (drawing 3 (a)) : A surface-preparation process is a process which performs plasma treatment under fixed conditions and adjusts the compatibility over the thin film material liquid of the bank forming face 100 and each class of bank 110. In the plasma treatment of this invention, the gas which contains a fluorine as introductory gas is used. It may be the reduced pressure plasma treatment under a reduced pressure ambient atmosphere, or you may be the atmospheric pressure plasma treatment under an atmospheric pressure ambient atmosphere. It is desirable that the oxygen of a constant rate is contained in reactant gas. As a fluorine system compound, the halogen gas of CF4, SF6, and CHF3 grade etc. is used.

[0037] ****** in which a front face tends to get wet to the fluid of arbitration, such as thin film material liquid, -- being hard -- or -- that is, it can know whether compatibility is shown or non-compatibility is shown by measuring the contact angle over the fluid of a material-list side. When plasma treatment of an organic material and the inorganic material is carried out to drawing 4 , drawing which measured how a contact angle would change with the mixing ratio of a fluorine compound and oxygen is shown. A contact angle is a contact angle over drainage system ink (ink which can be thinned with water). CF4 is used for this drawing as a fluorine system compound, polyimide is illustrated as an organic material and it has

illustrated SiO2 and ITO (Indium-Tin-Oxide) as an inorganic material. It is thought that the inclination which is similar according to whether it is organic or it is inorganic about other ingredients is seen. As shown in drawing 4 , under the ambient atmosphere where oxygen is excessive, an organic material and an inorganic material do not have a big difference in extent of a contact angle. However, if a fluorine system compound makes it excessive, the contact angle of an organic material will become large (it becomes non-compatibility when thin film material liquid is compatibility). On the other hand, change of the contact angle of an inorganic material is small. If oxygen is contained in reactant gas, a polar group will generate an inorganic material and an organic material by the oxidation by oxygen. However, in order for a fluorine compound molecule to enter into an organic material that a fluorine system compound is excessive, it is thought that the effect of a polar group decreases relatively. Therefore, while a fluorine system compound controls by excessive conditions compared with oxygen, by carrying out plasma treatment, bank 110 and bank forming face 100 front face can be set as a desired contact angle (compatibility) according to drawing 4 . especially -- best [of drawing 4] -- it is desirable to use a mixing ratio (CF4/CF4+O2=75%-90%), in order that the difference of both contact angle may consider as max. However, if an important point is for the difference of the contact angle between polyimide, and SOG and ITO to set up greatly, and there is about 70% or more of CF4 according to drawing 4 in order to attain this object, it will be thought that it is enough. For example, to thin film material liquid, surface treatment of the compatibility bank layer front face is carried out so that a contact angle may become 30 or less degrees. Moreover, to thin film material liquid, surface treatment of the non-compatibility bank layer front face is carried out so that a contact angle may become 40 degrees or more.

[0038] Reduced pressure plasma treatment or atmospheric pressure plasma treatment is performed so that a fluorine system compound may be made into introductory gas with this operation gestalt and oxygen may be mixed at a fixed rate from the above data. For example, in the plasma treatment of a capacity-coupling mold, the substrate which has the bank forming face 100 for the above-mentioned gas on sink one electrode in a reaction chamber is laid, and electric field are added from a power source. various a well-known approach, for example, direct current anodizing, a RF method, an inductive-coupling form, a capacity-coupling form, microwave methods, methods of adding electric field and a field to **, etc. can be looked like [how to add the energy to a reaction chamber], and it can apply to it.

[0039] For example, in the bank forming face 100 (base of a crevice 101), when SiO2 and a non-compatibility bank layer are formed for transparent electrodes, such as ITO, and a compatibility bank layer with polyimide, surface preparation of whenever [to thin film material liquid 130 / affinity] is carried out by the above-mentioned surface preparation so that it may become the sequence of a bank forming face >= compatibility bank layer > non-compatibility bank layer.

[0040] Film formation process (drawing 3 (b) - (d)) : A film formation process is a process which carries out sequential restoration of the thin film material liquid, and carries out the laminating of the thin film layer to the crevice 101 surrounded on the bank 110. As thin film material liquid 130, when applying to a display, an organic-semiconductor ingredient, the ingredient which doped the electron hole supply element as an electron hole transporting bed, the ingredient which doped the electronic supply element as an electronic transporting bed are used. It applies coloring resin etc., in applying to a light filter.

[0041] The thickness of the layer currently formed in the location corresponding to the thin film layer concerned adjusts the amount filled up with each thin film material liquid. In the thin film layer 131 of

the lowest layer, it is adjusted to an amount from which the thickness after a solvent component evaporates from thin film material liquid by heat-treatment becomes the compatibility bank layer 111 and an abbreviation EQC (broken line of drawing 3 (b)). in the thin film layers 132-13n above it, the thickness after a solvent component evaporates from thin film material liquid by heat-treatment is prepared in the corresponding location -- un--- the doubled thickness of compatibility bank layer 12x and compatibility bank layer 11x+1 -- abbreviation -- it is adjusted so that it may become equivalent (drawing 3 (c), (d)).

[0042] It is desirable to be based on an ink jet method as an approach filled up with thin film material liquid. It is because it can fill up with small equipment which can fill up a fluid into the location of arbitration with the amount of arbitration, and is used for a home printer according to the ink jet method. If thin film material liquid is filled up with an ink jet method, thin film material liquid will be heated and a solvent component will be removed. It requires that viscosity is usually several pc or less making it breathe out from an ink jet type recording head. For this reason, there is much discharge quantity compared with the thickness of a final required thin film layer. Just behind the regurgitation, thin film material liquid touches the compatibility bank layer arranged above final thickness. A solvent component evaporates by heat-treatment, the volume takes for decreasing, and thin film material liquid lowers the oil level, though an oil level is lengthened by the bank wall surface. Since thin film material liquid will be crawled if this oil level starts a non-compatibility bank layer, the point of contact of thin film material liquid and a wall surface moves to the compatibility bank layer under one step. Thus, if the oil level falls gradually and the volume of thin film material liquid decreases to near the thickness of a final thin film layer, the point of contact of the oil level of thin film material liquid and a wall surface will move even to the boundary of the compatibility bank layer and the non-compatibility bank layer of the right above of it which are located in the bottom in the bank layer which is in contact with the thin film material liquid. In the volume of the thin film material liquid after heat-treatment having been filled up with the thin film material liquid, the fill of thin film material liquid spreads ** to the height which totaled the non-compatibility bank layer and compatibility bank layer which are located in the bottom, abbreviation, etc., and is set up. For this reason, after an oil level moves to the boundary of the compatibility bank layer and the non-compatibility bank layer of the right above of it which are located in the bottom, an oil level does not fall any more. a volume decrease -- the thickness of the center section of thin film material liquid -- gradual -- falling -- all the parts from a contact part with a bank wall surface to a center section -- it is the phase which was and became equal thickness, and a thin film layer is solidified and it completes.

[0043] For example, in the thin film layer 131 of the lowest layer, as shown in drawing 3 (b), the regurgitation of the thin film material liquid 130 is carried out to the crevice 101 surrounded on the bank 110 from the ink jet type recording head 102 to the location of a broken line. And it heat-treats and is made the flat thin film layer 131. In the thin film layer 132 on it, as shown in drawing 3 (c), the regurgitation of the thin film material liquid 130 is carried out from the ink jet type recording head 102 to the location of a broken line on the thin film layer 131. And it heat-treats and is made the flat thin film layer 132. These processings are repeated until 13n of thin film layers is formed.

[0044] In addition, as an ink jet method, you may be the approach of carrying out the regurgitation by gassing by heat also in a piezo jet method. The nozzle and the piezo electric crystal component are equipped with and constituted from a piezo jet method by the pressure room. If an electrical potential difference is impressed to the piezo electric crystal component with which the fluid is filled up into the

pressure room, a volume change will arise in a pressure room and the drop of a fluid will be breathed out from a nozzle. By the method which carries out the regurgitation by gassing, the heating element is prepared in the pressure room which passes to a nozzle. A heating element is made to generate heat, the fluid of the nozzle neighborhood is boiled, air bubbles are generated, and the regurgitation of the fluid is carried out by the cubical expansion. A piezo jet method is desirable at a point without deterioration of the fluid by heating.

[0045] As described above, according to this operation gestalt 1, each thin film layer can be formed evenly. Moreover, by performing plasma treatment on the conditions which oxygen is mixing in a fluorine system compound, the non-compatibility on the front face of a bank made with the organic material to thin film material liquid and the compatibility of the bank front face made with the inorganic material and a bank forming face can be adjusted. And the contact angle which shows the degree of compatibility according to a property as shown in drawing 4 can be set up easily. That is, the bank itself can control the compatibility of a bank and a bank forming face certainly, without passing through many processes like before for compatibility control, maintaining high adhesion with a bank forming face. It can prevent by this that thin film material liquid flows out across a bank, the yield can be raised, and a manufacturing cost can be decreased.

[0046] (Operation gestalt 2) The operation gestalt 2 of this invention carries out the laminating of the bank by different approach from the above-mentioned operation gestalt. The production process sectional view of this operation gestalt is shown in drawing 5 . This operation gestalt is applied to all applications that fill up with a predetermined fluid the field which established the bank in the bank forming face in the configuration of arbitration, and was divided like the above-mentioned operation gestalt 1 on the bank. For example, when filling up coloring resin into a pixel field with the case where an organic-semiconductor ingredient is filled up with the display device using an organic-semiconductor thin film into a pixel field, or a light filter, it can apply.

[0047] Lower layer film formation process (drawing 5 (a) - (c)) : A lower layer film formation process is a process which forms the compatibility bank layer 111 in the bank forming face 100. An inorganic material is first applied by the same approach as the above-mentioned operation gestalt 1 (drawing 5 (a)). Subsequently, according to a bank configuration, a mask 140 is formed on an inorganic material layer (drawing 5 (b)). Subsequently, an inorganic material layer is etched, it leaves the field in which the mask 140 was laid, and an inorganic material is removed (drawing 5 (c)). The etching approach is chosen according to the property of an ingredient. In the case of the inorganic material of SiO2 grade, the wet etching which used etching reagents other than dry etching, such as fluoric acid (HF), is applicable. The compatibility bank layer 111 of the lowest layer is formed above. Next, an organic material is applied by the same approach as the above-mentioned operation gestalt (drawing 5 (d)). Subsequently, according to a bank configuration, a mask 142 is formed on an organic material layer (drawing 5 (e)). Subsequently, an organic material layer is etched, it leaves the field in which the mask 141 was laid, and an organic material is removed (drawing 5 (f)). The etching approach is chosen according to the property of an ingredient. In the case of organic materials, such as polyimide, the wet etching which used other etching reagents (NMP (N-methyl pyrrolidone)) of dry etching is applicable. The non-compatibility bank layer 121 is formed above. It is possible to change not the thing that etches a compatibility bank layer by using a non-compatibility bank layer as a mask like the above-mentioned operation gestalt 1 with this operation gestalt but a bank configuration [in / since it can etch independently / for each upper layer / a

compatibility bank layer] and the bank configuration in a non-compatibility bank layer. For example, width of face of a bank is narrowed as it goes to the upper layer from a lower layer, and it can form in a stairway configuration or a false taper configuration. Thus, if a bank is formed, when it can suppose that restoration of the thin film material liquid used as a thin film layer is easy, and a bank is overcome and it forms a circuit pattern, an open circuit of the wiring can be prevented. By choosing the configuration of this bank lower layer as a suitable thing, a thin film layer can be suitably prepared now. The above process (drawing 5 (a) - (f) is repeated the required number of laminating times (for example, n times), and bank 110 is formed like drawing 5 (g).) Since it is the same as that of the above-mentioned operation gestalt 1 about a surface treatment process and a thin film layer formation process, explanation is omitted.

[0048] Since according to this operation gestalt 2 the same effectiveness as the operation gestalt 1 is done so and also the configuration of each class of a bank can be changed as described above, the configuration of the optimal thin film layer can be set up according to an application device.

[0049]

[Example] The layer system of the example which applied the above-mentioned operation gestalt is shown. Drawing 6 is layer structure section drawing of the example which applied this invention to the light filter. As shown in drawing 6 , a substrate 200 is filled up with the batch member 210, it fills up with coloring resin 231-233 the pixel field 201 which forms in the shape of a grid and is surrounded by the batch member 210 seen from a flat surface, and this light filter is constituted. A substrate 200 is equivalent to the bank forming face of this invention, and coloring resin and adhesion consist of a good transparent ingredient, glass, a quartz, resin, etc. The batch member 210 is equivalent to a bank of this invention, and the black matrix layer 221 is formed as a compatibility bank layer as the resin layer (or inorganic insulator layer layer) 211 and a non-compatibility bank layer. The resin layer (or insulator layer layer) 211 operates resin orthopedically in a bank configuration, and is constituted. The black matrix layer 221 applies the organic insulating material containing an inorganic material or carbon, and is constituted. The coloring resin layers 231 (red), 232 (green), and 233 (blue) are equivalent to the thin film layer of this invention, are filled up with the resin with which the color of primary colors, such as red, green, and blue, was mixed every pixel field 201, and are constituted.

[0050] According to the above-mentioned configuration, as the resin layer (or insulator layer layer) 211 has coloring resin and compatibility, surface preparation is carried out, and surface treatment is carried out as the black matrix layer 221 shows coloring resin and non-compatibility. For this reason, if it is filled up with coloring resin with an ink jet method and heat-treats, the coloring resin layers 231-233 will be formed evenly. For this reason, image display which unevenness produces neither in brightness nor a color can be performed.

[0051] Drawing 7 is layer structure section drawing of the example which applied this invention to the organic-semiconductor light emitting device of a display. As shown in drawing 7 , this organic-semiconductor light emitting device forms bank 310 in the actuation substrate 300 at transparent electrode 341 pan, forms the organic-semiconductor layer 331 in the crevice 301 surrounded on the bank 310, and is constituted. The whole is covered and the metal electrode 351 is formed. The laminating of TFT, wiring, the insulator layer, etc. is carried out to a multilayer, and the actuation substrate 300 is constituted possible [impression of an electrical potential difference] between the transparent electrode 341 and the metal electrode 351. A transparent electrode 341 carries out the laminating of 0.05

micrometers - about 0.2 micrometers of the ITO(s) etc., is constituted, and is constituted possible [transparency of the light from the organic-semiconductor layer 331, and the reflected light by the metal electrode 351]. The bank 310 is constituted by a lower layer 311 and the upper layer 321. A lower layer 311 consists of inorganic materials which have compatibility in an organic-semiconductor ingredient, and is constituted by silicon oxide, silicon nitride, etc. which are formed by the CVD method, a spatter or the various coat methods, etc. The upper layer 321 consists of organic materials which show non-compatibility to an organic-semiconductor ingredient, and is constituted by an organic compound or an insulating organic compound etc. which has polyimide, an amorphous silicon, polish recon, and a fluorine. The organic-semiconductor layer 331 carries out the laminating of 0.05 micrometers - about 0.2 micrometers of ingredients which emit light by impression of electric field, for example, the well-known ingredients, such as polyphenylene vinylene (PPV), and is constituted. A metal electrode 351 carries out the laminating of 0.1 micrometers - about 1.0 micrometers (aluminum-Li) of the aluminum lithiums, and is constituted.

[0052] Since according to the above-mentioned configuration surface treatment is carried out, and surface treatment is carried out as the upper layer 321 shows the organic-semiconductor layer 331 and non-compatibility as a lower layer 311 has the organic-semiconductor layer 331 and compatibility, if an organic-semiconductor ingredient is filled up with and heat-treated by the ink jet method, the organic-semiconductor layer 331 will be formed evenly. For this reason, image display which produces neither unevenness nor a color omission in brightness or a color can be performed. Moreover, an electrode short circuit can be prevented, the dependability of the whole display can be raised, and a life can be prolonged.

[0053] Drawing 8 is layer structure section drawing of other examples which applied this invention to the organic-semiconductor light emitting device of a display. As shown in drawing 8 , this organic-semiconductor light emitting device forms bank 410 in the actuation substrate 400 at transparent electrode 441 pan, carries out the laminating of the electron hole transporting bed 431 and the organic-semiconductor layer 432 to the crevice 401 surrounded on the bank 410, and is constituted. The whole is covered and the metal electrode 451 is formed. About between the actuation substrate 400, a transparent electrode 441, the organic-semiconductor layer 432, and a metal electrode 451, it is the same as that of the example of above-mentioned drawing 7 . Bank 410 carries out the laminating of the compatibility layers 411 and 412 and the non-compatibility layers 421 and 422 by turns, and is constituted. The compatibility layer 411 consists of inorganic materials which have compatibility in an electron hole transport ingredient or an organic-semiconductor ingredient, and is constituted by silicon oxide, silicon nitride, etc. which are formed by the CVD method, a spatter or the various coat methods, etc. The non-compatibility layer 421 consists of organic materials which show non-compatibility to an organic-semiconductor ingredient, and is constituted by an organic compound or an insulating organic compound etc. which has polyimide or an amorphous silicon, polish recon, and a fluorine. The electron hole transporting bed 431 is constituted by ITO in which the ingredient which can carry an electron hole from the transparent electrode 441 which is an anode plate to the organic-semiconductor layer 432, for example, an electron hole supply element, was made to mix.

[0054] According to the above-mentioned configuration, as the compatibility layer 411 has the electron hole transporting bed 431 and compatibility, surface treatment is carried out, and surface treatment is carried out as the compatibility layer 412 has the organic-semiconductor layer 432 and compatibility.

Moreover, surface treatment is carried out as the non-compatibility layer 421 shows the electron hole transporting bed 431, the organic-semiconductor layer 432, and non-compatibility. For this reason, if it is filled up with the electron hole transporting bed 431 and the organic-semiconductor layer 432 with an ink jet method and they are heat-treated, each will be formed evenly. For this reason, image display which produces neither unevenness nor a color omission in brightness or a color can be performed. Moreover, an electrode short circuit can be prevented, the dependability of the whole display can be raised, and a life can be prolonged.

[0055] in addition, the structure of a light filter or organic electroluminescence devices can be boiled not only in the above but variously, and can be changed. For example, in organic electroluminescence devices, the laminating of an electronic transporting bed or other organic-semiconductor layers may be carried out further.

[0056] (Other modifications) it is not limited to the above-mentioned operation gestalt, and in the range of the meaning of this invention, many things are boiled, it changes and this invention can be applied the formation approach of a bank using a compatibility ingredient, a non-compatibility ingredient, and them is not depended above, but is deformable to versatility. By arranging by turns the layer from which extent of compatibility differs, the main point of this invention is in the point which is distorted and forms a thin film layer that there is nothing. For example, a bank is formed with the ingredient for bank formation in which thick-film-izing is possible, and also a bank of this invention may be formed by applying to a bank front face the ingredient in which compatibility is shown, and the ingredient in which non-compatibility is shown. For example, the diethylene-glycol methylethyl ether (C2H5OCH2CH2CH2OCH2CH2OCH3) and 2-perfluoro octyl ethyl acrylate (FCF2) 8CH2CH2 OOOCH=CH2 show non-compatibility to the thin film material liquid which has a polar-group molecule by itself.

[0057] Moreover, the above-mentioned surface treatment is not restricted to plasma treatment, and if it is the surface treatment approach that different compatibility under the same surface treatment conditions is processible as shown in drawing 4 , it is applicable. It is because the main point of this invention is in the point that surface treatment adjusts compatibility. Therefore, the ingredient which sets up compatibility is not restricted between an inorganic material and an organic material, and if it shows the property of the compatibility shown between specific ingredients at drawing 4 , it can apply the surface treatment of this invention between the specific ingredient.

[0058] moreover, the ingredient with which the above-mentioned bank is affinitive and the ingredient in which non-compatibility is shown -- a laminating -- carrying out -- ** -- it does not stop. For example, after constituting the configuration of this invention from a single member, forming so that the field which shows compatibility to thin film material liquid, and the field which shows non-compatibility may become by turns can also attain it. For example, a bank ingredient is constituted from a compatibility ingredient and it is possible to apply a non-compatibility ingredient in the shape of stripes. Paraffin besides the above-mentioned example etc. is mentioned to a non-compatibility ingredient. Moreover, the field which constitutes a bank ingredient from a non-compatibility ingredient, carries out UV irradiation to the shape of stripes, and is affinitive is made, or it decharges in the shape of stripes, a charge is used, and it is ********** in applying a compatibility ingredient ****. Furthermore a metal thin film is formed in the whole bank ingredient, and if immersed in the sulfur compound with the substituent which shows a sulfur compound with an affinitive substituent, and non-compatibility sequentially from the lower layer, a compatibility field and a non-compatibility field can be formed in the shape of stripes with the single

molecular association-ized film.

[0059]

[Effect of the Invention] According to the thin film formation approach of this invention, with a different ingredient, it can be distorted and the thin film layer formed can be formed by carrying out the laminating of the bank that there is nothing. Thereby, the engine performance and dependability of a device can be raised substantially. Moreover, according to the thin film formation approach of this invention, compatibility can be controlled possible [multilayering of a thin film] by performing surface treatment under fixed conditions, without passing through many processes for compatibility control. The cost which compatibility control takes can be reduced by this, and multilayering of a thin film can be enabled by uniform thickness. Since it is multilayered by the thin film formation approach which makes multilayering possible according to the display of this invention, a laminating is possible in the thin film layer of uniform thickness. Thereby, image display which produces neither unevenness nor a color omission in brightness or a color can be performed. Moreover, an electrode short circuit can be prevented, dependability can be raised and a life can be prolonged. Since it is multilayered by the thin film formation approach which makes multilayering possible according to the light filter of this invention, a laminating is possible in the thin film layer of uniform thickness. Thereby, image display which unevenness produces neither in brightness nor a color can be performed.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the thin film laminated structure concerning the operation gestalt 1 of this invention.

[Drawing 2] It is the production process sectional view of the thin film formation approach concerning the operation gestalt 1 of this invention.

[Drawing 3] It is the production process sectional view (continuation) of the thin film formation approach concerning the operation gestalt 1 of this invention.

[Drawing 4] It is property drawing explaining the relation between the mixing ratio of the fluorine system compound and oxygen concerning the principle of the surface treatment of this invention, and a contact angle.

[Drawing 5] It is the production process sectional view of the thin film formation approach concerning the operation gestalt 2 of this invention.

[Drawing 6] It is the sectional view of the example which applied this invention to the light filter.

[Drawing 7] It is the sectional view of the example which applied this invention to the organic-semiconductor light emitting device of a display.

[Drawing 8] It is the sectional view of other examples which applied this invention to the organic-semiconductor light emitting device of a display.

[Drawing 9] It is the explanatory view of the trouble in the conventional bank formation.

[Drawing 10] It is the explanatory view of the trouble in the conventional bank formation.

[Description of Notations]

100,200 300,400 Bank forming face (substrate)

101, 201, 301, 401 Crevice

110, 210, 310, 410 Bank

111-11n, 11x Compatibility bank layer

121-12n, 12x Non-compatibility bank layer

130 Thin Film Material Liquid

131-13n, 13x Thin film layer

102 Ink Jet Type Recording Head
